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Comanche series is in the lithological character of the upper limestones, which are described as compact, gray, more or less silicious, limestone with flints, a description that applies equally well to the Caprina limestone, near the middle of the Comanche series. In the almost complete absence of fossils, this limestone cannot now be identified with the Texan formation from the data furnished by the Mexican geologists. Mr. R. T. Hill,[1] however, in an incidental reference to the Catorce region, correlates the so-called "Hippurites" limestone of Mexico, which is probably the same as Castillo and Aguilera's upper limestone, with the Caprina. The same author also refers the lower fossiliferous beds of Catorce to the Trinity division of the Comanche series, but this reference is based on its stratigraphic position rather than either lithological character or faunal contents. From the known distribution of the Comanche series in that region it is at least possible that portions of the Texan and Pacific coast lower Cretaceous faunas may yet be found in direct statigraphic relation with each other in central Mexico.

With the occurrence of the Pacific lower Cretaceous fauna at Catorce, not a great distance from the Gulf of Mexico, and of the Texan or Gulf fauna in Sonora, much nearer to the Pacific, the question as to how the two faunas were kept separate becomes still more difficult. From the data now at hand the most plausible hypothesis seems to be that the sea transgressed the continent, first from one side and then from the other, but never quite crossed the shifting barrier.

T. W. STANTON.

## *Phylogeny of an Acquired Characteristic.* By A. HYATT. Proc. Am. Phil. Soc., Vol. XXXII.

Professor Hyatt's paper "Phylogeny of an Acquired Characteristic," is essentially a contribution to the philosophy of the Neo-Lamarkian school of evolutionists. It is in part a republication in substance of several earlier papers, with the matter now put into a more systematic shape. While primarily biological it possesses great interest for the geologist and perhaps merits a fuller review on that account as it is less likely to fall into his hands.

In the introductory chapter the author lays great stress on the importance of the study of the shells of Mollusca. After speaking of the relation of the shell to the animal, and of the different structures in the Cephalopod shell, he says: "All their parts, the shell proper, the siphuncle, the septa and the sutures are in correlation with each other and together make an index to the life history of the individual, which is unequaled in some respects among other existing or extinct animals." From the study of a single perfect specimen of a Cephalopod shell can be determined the particular characteristics of the individual at any stage of growth, from the embryonic condition represented by the protoconch, to the retrograde metamorphoses through which it may pass during old age.

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[1] Am. Jour. Sci., Vol. XLV., 1893, pp. 311, 312, 324.

The two sub-classes of the class Cephalopoda, Tetrabranchiata and Dibranchiata, with the four orders Nautiloidea, Ammonoidea, Belemnoidea and Sepioidea, are shown to have been differentiated from some common primitive stock, each order being specialized for its own peculiar habitat. The prominence of the depression or sinews in the aperture of the shell is correlative with the prominence of the hyponome or swimming organ of the Cephalopod, and therefore signifies the relative power of the animal as a swimmer. An open aperture is correlative with powerful arms for crawling on the bottom, while forms possessing shells with more or less constricted apertures must have had more or less limited powers as crawlers. In relation to the differentiation of the four orders the author says: "The *efforts* of the Orthoceratite to adapt itself fully to the requirements of a mixed habitat of swimming and crawling gave rise to the Nautiloidea; the *efforts* of the same type to become completely a littoral crawler evolved the Ammonoidea. The successive forms of Belemnoidea arose in the same way. But here the ground-swimming habitat and complete fitness for that was the object. The Sepioidea, on the other hand, represent the higher aims as well as the highest attainments of the Cephalopods in their evolution into surface-swimming and rapacious forms. We cannot seriously imagine these changes to have resulted from intelligent effort; but we can with Lamark and Cope picture them as due to efforts on the part of the animal to take up new quarters in its environment and thus acquire habits and structures suitable to the changed physical requirements of its surroundings and this position is better supported by facts than any other hypothesis."

The relationships of the Nautiloidea and Ammonoidea are next discussed. Many investigators have endeavored, and have failed, to arrange the palæozoic Nautiloidea in a single series, passing progressively from earlier straight forms, through arcuate to the closely coiled forms. Professor Hyatt is led to believe through his investigations, that instead of a single such series there are several, all originating from a primitive stock and each one passing progressively from the straight form through arcurate, loosely coiled to closely coiled forms.

The order Ammonoidea is in like manner a branch from the primitive stock. The author says: "Thus although both are orders and taxonomically equal, we cannot compare the whole of the Ammonoidea with the whole of the Nautiloidea, but only with a more or less perfect single series of that order." The Ammonoidea have primitive straight radicals, but they are few in number and become extinct in Devonian time, leaving several branches of closely coiled forms, the Goniatitinæ, from which the latter Ammonoids spring.

During the evolution of the Nautiloidea and Ammonoidea, the differentiation takes place most rapidly during the earlier periods of their phylogeny, and their differentiating parts are of more structural importance than later in the life-history. Professor Hyatt formulates these facts in the following general law of evolution: "*Types are evolved more quickly and there are greater structural differences between genetic groups of the same stock while still near the point of origin than appear subsequently. The variations or differences take place quickly in fundamental structural characteristics, and even the embryos may become different when in the earliest period of evolution, but subsequently only more superficial structures become subject to great variations.*"

This law however does not apply to the degenerate forms which appear during the stages of decline of the several genetic series.

In the phylogenetic series, characteristic modifications appear first in the later stages of growth of individuals. These modifications are transmitted to succeeding generations, but are progressively accelerated, appearing in earlier and earlier ontogenetic stages. The law of acceleration is formulated as follows: "*The ancestral characters are brought into contact with new adaptive characteristics, which are being continually introduced into the adult and adolescent stages of ontogeny, and these eventually replace the former which are crowded back to make room for them into earlier stages than those at which they first appeared, and in many cases the latter are reabsorbed and disappear during this process.*"

In the interpretation of the more or less uncoiled degenerate forms of the later phylogenetic stages of the Ammonoidea, the law of acceleration still governs the changes. During Jurassic time degenerate forms are local and the degeneration is exhibited only in the adult stages of the individual. In later Cretaceous time, the majority of the forms show degeneration wherever they occur, and this degeneration sets in in much earlier ontogenetic stages. The degeneration is exhibited by a reversion to earlier characteristics. The shell becomes straightened, looses its ornamentation and the sutures become more simple, but in all cases it can be shown from a study of the younger ontogenetic stages, that these degenerate forms spring from a closely coiled radical stock. In no case do retrogressive series give rise to secondary radicals which originate new series.

The second chapter is devoted to "Principles of Bioplastology," or the study of the correlation of ontogeny and philogeny. The chapter is made up largely of the explanation of technical terms. Five ontogenetic stages are recognized: (1) embryonic, (2) nepionic, (3) neanic, (4) ephebic, (5) gerontic. Each of these, except the embryonic, is divided into three substages the names of which are formed by the use of the prefixes *ana*, *meta* and *para*, as ananepionic, metanepionic and paranepionic. The corresponding phylogentic stages are designated by the use of the prefix *phylo*, as phylonepionic, etc.

The general adoption of a series of exact terms in investigations of this nature is a necessity, and no one is better fitted to propose these terms than Professor Hyatt. It is desirable that other investigators, as some have already done, should adopt this system of nomenclature.

Chapter III. is devoted to the discussion of the ontogenetic stages of the nautiloidea and ammonoidea. From direct observations Professor Hyatt has determined "*that the substages of development in ontogeny are the bearers of distal ancestral characters in inverse proportion and of proximal ancestral characters in direct proportion to their removal in time and position from the protocouch or last embryonic substage.*"

As a general rule the nepionic stage of nautiloidea draws to a close and the neanic characteristics begin to appear, at or near the completion of the first volution, which growth brings the whorl in contact with the apex or dorsal side of the couch. The ananeanic substage is marked by the first appearance of the impressed zone. This is the name given to the area on the dorsum affected by the contact of the dorsum of the growing whorl with the venter of the already formed whorl of the next inner volution.

This impressed zone can be readily seen to be at first due entirely to a mechanical cause, the resistance of the inner volution to the growing shell of the outer. It is the acquired character the phylogeny of which the author discusses in detail. It can be shown that the impressed zone is invariably consequent upon close coiling, as it is never found in adults of any ancient and normally uncoiled shells.

However as one ascends in the same genetic series to the more specialized nautilian involute shells, this purely acquired character through the action of the law of acceleration or tachygenesis becomes forced back, appearing as a rule in the nepionic stage before the whorls come in contact.

Chapter IV. is devoted to descriptive terms used in the following chapter, in which a large number of genera and species are described, some of which are new, with special reference to the history of the impressed zone.

The last chapter is a summary, and from it may be quoted the following conclusions which seem to be justified by the facts and arguments brought forward:

"1. The impressed zone is primitively a contact furrow, an acquired characteristic of the dorsum of the whorls of nautilian shells having large umbilical perforations, which appear either in the ananeanic or metaneanic substages, and rarely later in their ontogeny. There is abundant positive evidence that in these primitive forms this furrow is purely a mechanical result of the nautilian mode of growth, not appearing in the ontogeny before contact and either partially or entirely disappearing on the free gerontic volution.

"2. The impressed zone does occur independently of contact on the free dorsum of the paranepionic substage as a dorsal furrow in some close-coiled, highly tachygenic, nautilian shells in the Quebec group and in the Devonian.

"3. While there is no positive proof that the dorsal furrow originated through heredity in the paranepionic substages of these nautiloids of pre-Carboniferous age, there is also no satisfactory evidence that it originated in the young of such species as have this character through purely mechanical agencies.

"4. There is no positive evidence that the similar dorsal furrow which also appears at the same age in the young shells of *Coloceras globatum* and perhaps *Coelogasteroceras canaliculatum* among Carboniferous nautiloids can be explained only when it is considered as a transmitted, tachygenetic characteristic.

"5. This fourth conclusion is supported by the presence of a similar dorsal furrow in the paranepionic substage of the young shells of all the nautiloids of the Jura so far as observed.

"6. The fourth and fifth conclusions are rendered still more probable by the presence of the dorsal furrow at an earlier age, the metanepionic substage, in all the nautiloids so far as observed, from the beginning of the Cretaceous, through the Tertiaries to and including the living species of the genus Nautilus. Its presence on the cystoceran volution in Cretacic shells can be explained only when it is considered as a transmitted, tachygenetic characteristic derived from the ancestral, nautilian shells of the Jura, which have the same characteristic at a later age, *i. e.*, in the paranepionic substage.

"7. The first conclusion is also sustained by the parallel phylogeny of the impressed zone in the ancestral forms of the Ammonoidea, the Nautilinidæ and especially in Mimoceras, the radical genus of this family.

"8. The fourth, fifth and sixth conclusions are also supported by the presence of a contact furrow on the dorsum of the earliest age of the conch in the specialized and highly tachygenic forms of the Goniatitinæ of the Devonian and of all the remaining Ammonoids to the end of the Cretaceous.

"9. These cumulative results favor the theory of tachygenesis and diplogenesis, and are opposed to the Weissmannian hypothesis of the subdivision of the body into two essentially distinct kinds of plasm, the germplasm, which receives and transmits acquired characteristics, and the somatoplasm, which, while it is capable of acquiring modifications, either does not or cannot transmit them to descendants."

S. W.

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*The Protolenus Fauna.* By G. F. MATTHEW. Trans. N. Y. Acad. Sci., Vol. XIV., pp. 101–153. Plates I.–XI.

In a paper entitled *The Protolenus Fauna*, Mr. G. F. Matthew has added an important contribution to our knowledge of the Cambrian faunas of New Brunswick.

The Etcheminian Series, considered as pre-Cambrian by Mr. Matthew, and the overlying St. John Group, present similar stratigraphic features in New Brunswick and Newfoundland. In Newfoundland the Olenellus fauna is found in the same position as observed elsewhere, viz., preceding the Paradoxides fauna, but in New Brunswick the fauna characterized by Olenellus is absent, and the Protolenus fauna takes its place stratigraphically.

The author publishes a list, with notes and descriptions, of seventy-four species and varieties belonging to the Protolenus fauna, twenty-eight of which are new, with two new genera, *Pelagiella*, a new genus of Gasteropoda, and *Micmacca*, a new genus of Trilobites.